

Appl. No. : 09/727,424
Filed : December 1, 2000

AMENDMENTS TO THE CLAIMS

Please amend the Claims as follows. Insertions are shown underlined while deletions are ~~struck through~~. Please cancel Claims 14-15 without prejudice.

1 (currently amended): A method for optimizing operation of a machine assembly while being manipulated by a user, said machine assembly comprising plural replaceable devices, each device being operated by a control module, the input-output relationship of which control module is regulated by control parameters, said method comprising the steps of:

(a) operating the machine using control modules;

(b) during step (a), optimizing the input-output relationship of at least ~~one~~ single control module by coding into templates parameters fully or partially regulating ~~the~~said single control module, said templates of said single control module being subjected to heuristic processing, wherein output of the machine assembly is evaluated based on a combination of ~~on~~(i) the user's ultimate choice during the operation and (ii) a preselected target used separately, to obtain at least one fitted set of parameters at each evaluation for said single control module, the parameters of which are optimized based on both of the evaluations; and

(c) operating the machine assembly using the optimized control module.

2 (previously presented): The method according to Claim 1, wherein the control module comprises a main control module and an auxiliary control module for adjusting output of the main control module, and step (b) is conducted on the auxiliary control module.

3 (original): The method according to Claim 2, wherein the main control module and the auxiliary control module are arranged in series.

4 (previously presented): The method according to Claim 2, wherein the main control module and the auxiliary control module are arranged in parallel.

5 (previously presented): The method according to Claim 1, wherein the control module comprises a central control module and multiple local control modules each receiving signals from the central control module and outputting signals to the respective replaceable devices, and step (b) is conducted on the central control module.

6 (original): The method according to Claim 1, wherein the heuristic processing is evolutionary computation, and the templates are chromosomes.

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7 (original): The method according to Claim 6, wherein the control module regulated by control parameters is provided with a fuzzy inference system comprising a matrix of fuzzy rules which are regulated by preselected parameters, and the optimization step is conducted by at least one of the following:

- (i) revising the fuzzy rule matrix by extracting a section from the matrix and coding elements of the section into chromosomes;
- (ii) modifying the configuration of the fuzzy rule matrix defined by membership functions by coding elements of the membership functions into chromosomes; or
- (iii) changing a level of an input of the parameters and a level of an output of the fuzzy inference system by coding elements of the levels into chromosomes.

8 (previously presented): The method according to Claim 7, wherein the level of the output of the fuzzy inference system in (iii) is evaluated by the user.

9 (original): The method according to Claim 1, wherein the machine assembly is a watercraft.

10 (original): The method according to Claim 9, wherein the replaceable devices include a trim apparatus and an electronic throttle.

11 (currently amended): An optimization apparatus for optimizing an operation characteristic of a unitary apparatus that can be used as a combined apparatus by combining other apparatuses used by a user, the optimization apparatus comprising:

an optimization process device for optimizing the operation characteristic of the unitary apparatus, with a functional characteristic of the combined apparatus as an evaluation criterion, said optimization process device comprising:

- (i) at least a single control module regulated by control parameters for controlling operation of the unitary apparatus;
- (ii) an autonomous evolutionary process unit for optimizing the operation of thesaid single control module by selecting a portion of the control parameters based on a predetermined evaluation criterion;
- (iii) an autonomous evaluation unit for evaluating the operation of the unitary apparatus and providing the evaluation to the autonomous evolutionary process unit; and

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(iiiiv) an interactive evolutionary process unit for optimizing the operation of thesaid single control module by selecting another portion of the control parameters based on the user's choice during the operation of the unitary apparatus; and

(v) an evaluation input unit for inputting by the user an evaluation of the operation of the unitary apparatus to the interactive evolutionary process unit.

12 (previously presented): The optimization apparatus of Claim 11, wherein the control module is used as an auxiliary control module, and the optimization apparatus further comprises a basic control module for deciding a manipulated variable of the unitary apparatus based on predetermined input information, said auxiliary control module being arranged and connected in parallel to or in a series with the basic control module.

13-15 (canceled)

16 (currently amended): The optimization apparatus of Claim 1411, wherein the optimization operation unit carries out operation with regard to optimization using heuristics.

17 (original): The optimization apparatus of Claim 16, wherein the heuristics is an evolutionary calculation method.

18 (original): The optimization apparatus of Claim 11, wherein the unitary apparatus is a power generator for a combined apparatus, and the other apparatuses are a body of the combined apparatus.

19 (original): The optimization apparatus of Claim 11, wherein the unitary apparatus is an outboard motor and the other apparatuses are a hull.

20 (original): The optimization apparatus of Claim 11, wherein the unitary apparatus is an electrically-driven auxiliary power device and the other apparatuses are a bicycle or wheelchair.

21 (original): The optimization apparatus of Claim 11, wherein the unitary apparatus is an electronically-controlled fuel injection device of a motor and the other apparatuses are an electronic throttle device of the motor.

22 (original): The optimization apparatus of Claim 11, wherein the unitary apparatus is an electronic throttle device of a motor and the other apparatuses are an electronically-controlled fuel injection device of the motor.

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23 (original): The optimization apparatus of Claim 11, wherein the unitary apparatus is a body of a robot and the other apparatuses are a head, arms and /or legs of the robot.

24 (original): The optimization apparatus of Claim 11, wherein the unitary apparatus is an indoor machine of an air conditioner and the other apparatuses are an outdoor machine of the air conditioner.

25 (original): The optimization apparatus of Claim 11, wherein the unitary apparatus is an outdoor machine of an air conditioner and the other apparatuses are an indoor machine of the air conditioner.

26 (previously presented): The method according to Claim 1, wherein the evaluation of output of the machine assembly by the user's ultimate choice and that by the preselected target are switched based on time or the user's choice.

27 (previously presented): The method according to Claim 7, wherein the section extracted in (i) and/or the membership functions to be modified in (ii) are/is evaluated by the preselected target value.
